INVESTIGATE PLOW BLADE OPTIMIZATION

BACKGROUND

The plow blade, which is bolted to the snow plow, is the component of the plowing system that makes contact with the roadway surface. Multiple blades are currently on the market that may last longer than flame-hardened steel blades, which are the standard blades that ODOT is currently using. ODOT was encouraged to pursue further research to compare the cost-effectiveness of using the specialty blades in place of the standard blades and to identify safe and efficient procedures for replacing the standard blades that are currently in use.

RESEARCH CONTEXT

This study determines a usage strategy based on safe, efficient, and cost-effective methods for changing and purchasing plow blades, recommends specialized blade changing equipment to assist and protect personnel and plow blades based on condition types.

RESEARCH APPROACH

A survey was developed to gather information about current blade usage at ODOT garages. Through the survey and discussions with the technical liaison committee, the research team identified six garages receiving different snowfall amounts to include in a two year evaluation. The blades evaluated during this study included standard flame-hardened steel blades in various configurations, carbide-tipped blades, JOMA blades, PolarFlex blades, and BlockBuster XL Classic blades. Data was collected using a digital video recorder equipped with a global positioning system and an infrared vision camera for each plow truck included the study, and measurements of each blade were collected periodically during the two winter seasons to determine the rate of wear. The research team watched over 5,000 hours of plowing video, a sample is seen in Figure 1, in order to calculate the wear per mile of each blade type while accounting for surface type, plowing speed, and road condition.

KEY POINTS

- All the specialty plow blades tested in this two year in-field research project proved to have a longer life span than a standard flame harden steel blade currently used at ODOT. However, with high capital cost, these longer life spans did not always show a cost savings.
- This research showed that having a counterbalance system on the plow does assist in a longer blade life for the standard blades.
- Blades with a longer life span allow fewer blade changes which means operators and mechanics do not have to lift heavy blades as frequently and there is less truck downtime during events.

This research project was sponsored through the Ohio Department of Transportation and Federal Highway Administration.

RESEARCH FINDINGS & CONCLUSIONS

Multiple analysis were reviewed to determine the blade wear and its significant factors. Once blade wear is determined, a cost may be associated with each blade type, Figure 2 presents the cost variables used in a Monte Carlo simulation. When analyzing the Year One data, the results indicated that implementing the carbide tipped blade and the XL Classic blade will result in a cost savings. The remaining blades would cost more than the equivalent number of standard blades. The PolarFlex has an $83 additional cost as compared to a standard blade, while the JOMA has a $707 additional cost compared to a standard blade. The results of the analysis from Year Two indicate that the PolarFlex and XL Classic have a cost savings of $778 and $302, respectively, when implemented in place of a standard blade as presented in Table 1.

A) Plow in "Down" Position, Utilized

B) Plow in "Up" Position, not Utilized

Figure 1: Sample of Plow Position on Video – A) Plow on Road Surface, B) Plow not Utilized.

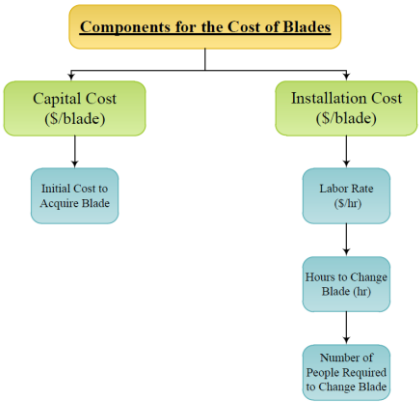

Figure 2: Variables Used to Determine the Cost.

Year One Data			Year Two Data			Year One and Two Data		
Blade	Rank	Cost Savings when compared to Equivalent Standard Blades	Blade	Rank	Cost Savings when compared to Equivalent Standard Blades	Blade	Rank	Cost Savings when compared to Equivalent Standard Blades
XL Classic	1	$534	PolarFlex	1	$2,554	PolarFlex	1	$778
Carbide Single	2	$80	XL Classic	2	$1,125	XL Classic	2	$426
Standard	3	$0	Middle Guard	3	$375	Standard	3	$0
PolarFlex	4	-$83	Double Stack	4	$278	Carbide Single	4	-$29
JOMA	5	-$707	Carbide Double	5	$145			
			Standard	6	$0			
			Carbide Single	7	-$29			
			No Counterbalance	8	-$107			

Note: A number 1 rank means the most cost savings per blade implemented in place of a standard blade. If a blade is below the standard blade rank, there is a cost associated with implementing that blade instead of a standard blade and will be denote with a negative sign on the cost.

Table 1: Ranking of Blades throughout Evaluation.

RECOMMENDATIONS FOR IMPLEMENTATION

Implementation of specialty blades in ODOT's fleet is a decision that the managers of each garage must make. There are cost savings and risks to implementing each of the specialty blades. Cost savings are observed for two specialty blades, the carbide and XL Classic blade in the first year, while cost savings are observed for the double stacked carbide tipped, double stacked standard, standard with additional middle guard, PolarFlex, and the XL Classic blades during the second year of the study. The single stacked carbide tipped and the standard blade on a truck with no counterbalance were found to have an additional cost when implemented in place of a standard blade or a truck with a counterbalance, in the second year of the evaluation. The single stacked carbide, PolarFlex, and XL Classic are tested in both seasons of the evaluation; when reviewing the data for both years, a cost savings is associated with implementing the PolarFlex and XL Classic. If a blade is damaged and is no longer useable, a specialty blade would cost more money to replace than a standard blade. Reviewing the routes and considering the operator's experience may help to reduce the likelihood of a blade breaking; however, there is no way to completely eliminate the risk of breaking a blade, regardless of the blade type.

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